

Syllabus - Biology 112-09 - Spring 2020
Evolution, Form, and Function of Organisms

Course meeting: RITA 152 – TR 12:15-1:30

Instructor: Dr. Brian Scholtens

Office: RITA 268 (lab); 953-8081; scholtensb@cofc.edu

Office hours: 3:00-4:30pm Tuesday and Thursday or by appointment – I'm pretty flexible



Course description: This is a course for biology majors covering life and living systems. It will emphasize the evolution, form and function of organisms. This course should help prepare you for upper level courses in organismic biology.

Student Learning Outcomes:

Demonstrate an understanding of the basics of evolutionary theory; how populations evolve and the causes.

Use fundamental population genetics to show evolutionary change in populations.

Relate the basic structures of plants and animals to how they operate as organisms.

Demonstrate an understanding of the interactions among organ systems in plants and animals.

Be able to compare plant and animal adaptations to environments, particularly to life on land.

Text: Biological Science, 6th Ed. by Freeman.

Note: Biology 112L is a co-requisite of Biology 112. The laboratory manual for Biology 112L is available at the bookstore.

<u>Tentative Grading Scale:</u>	93-100	A
	90 & above	A-
	87 & above	B+
	83 & above	B
	80 & above	B-
	77 & above	C+
	73 & above	C
	70 & above	C-
	67 & above	D+
	63 & above	D
	60 & above	D-
	below 60	F

This is the guaranteed scale. If you earn a particular percentage of the total points you are guaranteed the grade indicated by the scale. At the end of the term, I have the option of lowering this scale, if I feel it is justified. Do not count on this. Always assume that the grade you earn based on this scale is the grade you will receive.

<u>Point Distribution:</u>	3 midterm exams (100 pts each)	300
	Homework	150
	Attendance & Participation	30
	<u>final exam</u>	<u>150</u>
	total	630

Course Policies

Attendance: I will not take attendance each day. I leave it up to you as adults to decide how you should best spend your time. I feel the lectures are important. In fact, although I will generally follow the text closely, all exam questions will come from lectures, and several questions on each exam will not be covered by your reading assignments (remember, not all information about biology is in your text; though you may feel like there is more than you ever wanted to know). "It wasn't in the readings" will not be an acceptable justification for a missed exam question. Make-up exams will be scheduled only for students with valid excuses. These must be cleared with me **before** the missed exam. It is easiest to contact me by email.

Final exam: Saturday, 25 Apr 2020; 4:00-7:00 pm

Accommodations: Any student in this class who has a documented disability should speak to me as soon as possible, as well as contact the Center for Disability Services (CDS/SNAP program), located on the first floor of the Lightsey Center, Suite 104, (843) 953-1431, SNAP@cofc.edu

Honor Code: Students are required to adhere to the guidelines outlined by the Honor Board in the Student Handbook (please see <http://studentaffairs.cofc.edu/honor-system/studenthandbook/2015-2016-student-handbook.pdf>, sec. 9, p. 10 and 11 specifically). **This includes lying, which will not be tolerated in this course.** All work that you turn in for this course (whether for assignments, quizzes, or exams) must be **your own independent scholarship**, and must not have been used, partially or totally, to fulfill requirements for other classes. Any form of plagiarism (intentional and unintentional), cheating, or presenting someone else's work as one's own will be treated as a serious academic transgression and will be communicated accordingly by the instructor as an honor code violation to the Division of Student Affairs. Be especially cautious of plagiarism when using Internet sources. Cheating, attempted cheating, or plagiarism will result in a grade of zero on that assignment or exam and may result in a final overall grade of F or XXF (failure due to academic dishonesty) for the course.

Use of Electronic Devices: During our class, I will **NOT** allow any electronic devices, i.e. computers, phones, tablets. It is important for you to understand that, no matter what you think, research shows that people cannot actually do a good job of multitasking. You cannot listen and text at the same time (nor drive and text!) and expect to fully comprehend what is covered in class. You need to be actively, physically involved. Ideally, you will actually write notes – this has been shown to be much better than just following along with my lecture notes and thinking, “yeah, I understand that.” The physical act of writing helps you place information into more permanent memory. Take advantage of what we already know about learning! I will provide you with hard copies of the slides I show in lecture so you can associate your notes with those slides and then use them to study.

Introduction to Cell and Molecular Biology/Evolution, Form, and Function of Organisms

BIOL 111 & 111L/BIOL 112 & 112L

Department: Biology

General Education Learning Goals & Objectives

This general education science sequence provides a background for understanding and evaluating contemporary topics in biology. Students develop a foundational understanding of core concepts to use and on which to expand in upper level courses. They also develop the critical competencies that form the bases for the practice of science and use of scientific knowledge.

Core Concepts

This 2-semester course sequence in general biology addresses fundamental principles in biology to prepare students for sophomore and upper level courses in biology:

- **EVOLUTION:** The diversity of life evolved over time by processes of mutation, selection, and genetic change. The theory of evolution by natural selection allows scientists to understand patterns, processes, and relationships that characterize the diversity of life.
- **STRUCTURE AND FUNCTION:** Basic units of structure define the function of all living things. Structural complexity, together with the information it provides, is built upon combinations of subunits that drive increasingly diverse and dynamic physiological responses in living organisms. Fundamental structural units and molecular and cellular processes are conserved through evolution and yield the extraordinary diversity of biological systems seen today.
- **INFORMATION FLOW, EXCHANGE, AND STORAGE:** The growth and behavior of organisms are activated through the expression of genetic information at different levels of biological organization and depend on specific interactions and information transfer.
- **PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER:** Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamic and will be explored to understand how living systems operate, how they maintain orderly structure and function, and how physical and chemical processes underlie processes at the cellular level (i.e. metabolic pathways, membrane dynamics), organismal level (i.e. homeostasis) and ecosystem level (i.e. nutrient cycling).
- **SYSTEMS:** Living systems are interconnected and interacting and biological phenomena are the result of emergent properties at all levels of organization, from molecules to ecosystems to social systems. The course will explore the dynamic interactions of components at one level of biological organization to the functional properties that emerge at higher organizational levels.

The specific topics covered in each course include:

Biology 111 & Biology 111L

- Chemical and physical properties of life
- Cell form & function
- Energetics, metabolism, and photosynthesis
- The cell cycle
 - Mitosis and cell reproduction
 - Meiosis and sexual reproduction
- Mendelian genetics / Patterns of inheritance
- Human Inheritance
- The molecular basis of inheritance

- DNA and protein production
- Regulation of gene expression
- Some aspects of biotechnology

Biology 112 & Biology 112L

- The development of evolutionary thinking
- Basic evolutionary processes
- Comparative plant form & function
- Comparative animal form & function

Core Competencies

- **Nature of Scientific Knowledge**
 - Understand the intellectual standards used by scientists to establish the validity of knowledge, evidence, and decisions about hypothesis & theory acceptance. These standards include: 1) science relies on external and naturalistic observations, and not internal convictions; 2) scientific knowledge is based on the testing of hypotheses and theories, which are under constant scrutiny and subject to revision based on new observations; 3) the validity of scientifically generated knowledge is established by the community of scientists through peer review and open publication of work.
 - Understand that new ideas in science are limited by the context in which they are conceived; are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly, through contributions from many investigators.
 - Understand that science operates in a world defined by the laws of chemistry and physics.
 - Understand the differences and relationships among scientific theories, hypotheses, facts, laws, & opinions.
 - Understand the differences between science and technology, but also their interrelations.
 - Understand the dynamic (tentative) nature of science.
- **Scientific Methods of Discovery**
 - ¹Understand the methods scientists use to learn about the natural world (observing; questioning; formulating testable deductive hypotheses; controlled experimentation when possible; observing a wide range of natural occurrences and discerning (inducing) patterns).
 - Apply physical/natural principles to analyze and solve problems.
- **Develop a Scientific Attitude**
 - Develop habits of mind that foster interdisciplinary and integrative thinking (within biology; between biology and other sciences; between science and other disciplines).
 - Develop an appreciation for the scientific attitude - a basic curiosity about nature and how it works.
- **Develop scientific analysis and communication skills**
 - Develop quantitative reasoning skills (quantitatively expressing the results of scientific investigations, or patterns in nature and using knowledge of biological concepts to explain quantitatively-expressed data or patterns).
 - Understand the probabilistic nature of science and the use/application of inferential statistics to test hypotheses.
 - Develop scientific information literacy (library, internet, databases etc...); find and evaluate the validity of science-related information.
 - Communicate scientific knowledge, arguments, and ideas in a variety of different contexts (scientific, social, cultural), utilizing a variety of different media (scientific articles, policy statements, editorials, oral presentations etc.).
 - Develop cooperative problem-solving skills (working effectively in teams), but also habits of mind and skills that foster autonomous learning.

¹ This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can apply physical/natural principles to analyze and solve problems.*

- **Develop an appreciation for the impact of science on society.**
 - Develop an appreciation of humans as a part of the biosphere and the ²impact of biological science on contemporary societal/environmental concerns.
 - Knowledge of the history of the biological sciences and the influences of politics, culture, religion, race, and gender on the scientific endeavor.

Signature assignments for measuring learning outcomes

Learning Outcome 1: Students apply physical/natural principles to analyze and solve problems.

This learning outcome is assessed using the poster (or scientific article) generated in Biology 112 lab as part of the multi-week student-directed independent research project. In this project students use data they collect (or has been collected in actual research investigations) to test an hypothesis of their choosing. These projects may be themed, with all student groups addressing different aspects of a larger question, emphasizing the interdependence of various research groups needed to address complicated problems. This multi-week project begins the class identifying what questions need to be addresses in the larger problem. Individual student groups then become experts in these areas of the larger problem. The smaller research teams develop a hypothesis, and write a research proposal to test their hypothesis. Students collect (or use already collected data), summarize and statistically analyze the data, and draw conclusions.

Learning Outcome #2 - Students demonstrate an understanding of the impact that science has on society.

Biology 112 lab Students produce a written document based on one of the case-based labs (examples - policy statement, article, stake-holder professional letter or poster) that requires them to research and apply biological knowledge or evidence to defend or critique a proposed solution to a biology-related societal issue. Although the choice of the specific issue or proposed solution is course-section specific, some examples of potential issues include

- exploring environmental/health impacts of genetically modified organisms
- the use of performance enhancing drugs in sports
- the development of antibiotic resistance in disease organisms

² This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can demonstrate an understanding of the impact that science has on society.*